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Docket No. SAR 12743

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of

MICHAEL JAMES LIBERATORE et al

Serial No.: 09/183,479 Examiner: c. Mayes

Filed: October 30, 1998 Group Art Unit: 1734

For: IMPROVED METHOD OF MAKING
TRANSMISSION LINES AND
BURIED PASSIVE COMPONENTS
IN GREEN TAPE

BRIEF ON APPEAL

To: Assistant Commissioner for Patents
Washington, DC 20231

Sir:

This is an appeal from a Final Rejection dated April 5, 2002. A Notice of Appeal was filed July 3, 2002. Three copies of this Brief are attached. The fee for filing the Brief is to be charged to Deposit Account 13-4542. A Petition for an extension of time in duplicate, and the fee therefor, is also attached.

(1) REAL PARTY IN INTEREST

The real party in interest in this application is Sarnoff Corporation of 201 Washington Road, Princeton, NJ 08540, the assignee of 100% of the interest of this application.

(2) RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences relating to this application, designated as Docket No. SAR 12743, or other related applications.

(3) STATUS OF CLAIMS

The claims are 1-7, 9 and 11.

In a response under 37 CFR 1.116 dated June 4, 2002, amendments to the claims were proffered. However, the Examiner, per an Advisory Action dated 6/14/2002, did not enter these amendments.

Thus the claims remain as they were originally filed and/or as amended in a response submitted on November 13, 2000 in the parent application.

(4) STATUS OF AMENDMENTS

The claims are unamended in this CPA application as filed.

(5) SUMMARY OF THE INVENTION

The invention is directed to a method of forming transmission lines and openings for buried passive components in green tapes, including embossing a channel into a green tape using heat and pressure, and then screen printing a suitable ink into the openings. See page 5 lines 17-23, and page 6 line 25.

The inks can be of conductive or non-conductive materials, see page 5 lines 20-21 and page 11 line 29-page 12 line 2. The filled channels can be buried between other green tape layers. Further, the resulting green tape stack can be adhered to a metal support substrate.

(6) THE ISSUES

1) Whether claims 1-3 are unpatentable under 35 USC 103 over an IBM Technical Disclosure Bulletin in view of Amendola et al.

2) Whether claims 4-7 are unpatentable under 35 USC 103 over IBM and Amendola further in view of Vitriol.

3) Whether claims 9 and 11 are unpatentable under 35 USC 103 over the IBM, Amendola et al and Vitriol et al references further in view of Prabhu.

(7) GROUPING OF CLAIMS

Claims 1-7 are directed to a method comprising the steps of embossing an opening in a green tape and filling the opening by screen printing with a suitable ink.

Claims 9 and 11 are directed to making buried passive components by the embossing and filling steps of claims 1-7, and then burying the green tape in a green tape stack which is aligned onto a support substrate, and fired.

These two groups of claims will be discussed separately.

(8) THE REJECTIONS

Claims 1-3 have been rejected over IBM in view of Amendola et al. These claims are directed to embossing a channel or opening in a green tape and filling the channel by screen printing with a suitable ink.

Claims 4-7 have been rejected over IBM in view of Amendola et al further in view of Vitriol et al. Various components having a green tape channel or opening filled with an ink, including a conductive ink, a capacitor ink or a resistor ink, can be used.

Claims 9 and 11 also perform these two steps, but in addition require that the embossed and filled green tape be buried in a green tape stack, which is adhered to a support substrate and fired. These claims have been rejected over IBM in view of Amendola et al further in view of Vitriol et al and further in view of Prabhu. These claims will be discussed separately and are believed to be separately patentable.

(9) THE ARGUMENTS

The First Issue: The present invention is directed to making openings in green tapes particularly suitable for use as transmission lines. Such lines must have a uniform size and

depth. The prior art method was to screen print a transmission line on the surface of a green tape, or a plurality of green tapes. The green tapes were then aligned, mounted on a substrate if desired, and then laminated under heat and pressure. During this lamination step, fine transmission lines are flattened and can be distorted and thus lose line definition, which is particularly true for thicker conductive lines and deeper channels. This leads to poorer transmission line properties.

The present invention is directed to embossing channels or openings in the surface of green tapes which can then be filled by screen printing. The screen printed inks used do not extend above the surface of the green tapes, and thus are not distorted or flattened during the lamination process which requires heat and pressure, providing greater control of the resultant product.

In addition, because embossed channels can be deeper than screen printing allows, the transmission lines can be thicker, improving the circuitry used for microwave frequencies for example. Increasing the thickness of conductive lines reduces the resistance of the conductors, and allows the transmission lines to operate at higher frequencies, resulting in lower losses. Using this technique for buried passive components results in

tighter tolerances for width, depth and length for transmission lines for example as well.

The Examiner has rejected claims 1-3 over IBM in view of Amendola et al.

The IBM reference is directed to making openings in green tape that are at least partially filled with air after firing. This is done, inter alia, by "mechanically stamping" openings in the green tape which can be filled by "squeegeeing". In order to obtain air pockets, recesses are made in a second, adjacent green tape, which recesses are filled with a material that vaporizes during the firing step. The result is the formation of air gaps after firing the filled green tapes. Overall this reduces the effective dielectric constant of the filler materials in the green tapes.

No lines of any sort are suggested by IBM. Thus the purpose of the IBM reference is very different; no mention of applying heat or pressure while making the channels or openings is found; and the channels are deliberately not to be wholly filled in the finished product, as contrasted to the product of appellants.

Thus appellants submit this reference does not suggest making similar products in a similar way at all; and thus submits

there is no reason for the Examiner to cite it in the absence of hindsight, based on appellants' disclosure, which is improper. See In re Shaffer, 108 USPQ 326 (CCPA 1956) wherein the Court stated "...it is not enough for a valid rejection to view the prior art in retrospect once an applicant's disclosure is known. The art itself should be viewed by itself to see if it fairly disclosed doing what an applicant has done" at 329.

The Examiner has combined IBM then with Amendola et al. Amendola et al is directed to forming openings in green tapes, firing them, and then filling the openings with a metal. This is done to avoid the shrinkage and subsequent misalignment of metal filled openings after the green tapes are fired.

However, this method requires two firing steps; one after forming the original channels or openings in the green tape; and the second after the channels or openings are filled with a metal paste.

The present method does not require two firing steps at all, a great cost savings, but both forms channels and fills them prior to firing.

See In re Imperato, 179 USPQ 730 (CCPA 1973) which explains that the art must contain something to suggest the desirability

of a combination of references. See also In re Fine, 5 USPQ 2nd 1596 (CAFC 1988), which reiterates a longstanding rule of law that "obvious to try" is not a legitimate test of obviousness, and that teachings of references can be combined *only* if there is some suggestion or incentive to do so" at 1599. Appellants submit there is no reason to combine IBM for its teaching of screen printing with Amendola et al, whose method steps are different and require a different sequence from that of appellants, except in the light of hindsight, which has long been held to be improper.

Thus even if IBM is considered with Amendola et al, appellants submit the Examiner has failed to make a prima facie case of obviousness here.

The Second Issue Claims 4-7 require particular ink materials to fill the embossed channels or openings. Claim 4 requires a resistor ink, and claims 5-7 require a capacitor ink. The Examiner has added a reference to Vitriol et al in rejecting these claims.

Vitriol et al is directed to shaping or bending a green tape or green tape stack prior to firing. This reference does disclose that one can print screen capacitors, resistors and the like on

green tapes, but does not disclose pre-forming openings other than via holes, and does not suggest, disclose or require embossing at all. Claims 4-7 are dependent on claim 1, and thus require embossing channels or openings under heat and pressure, nowhere discussed or suggested by Vitriol et al. But these features lie at the heart of the present invention, not whether capacitors or resistors are screen printed onto green tapes. Thus appellants submit that even when these three references are considered together, they do not suggest the embossing step of appellants, as required by all of the claims 4-7.

The Third Issue Claims 9 and 11 not only require embossing channels or openings on the surface of green tapes, and filling the channels or openings by screen printing a component material into the opening, as required by claims 1-7, but also require burying the embossed and filled green tape in a green tape stack, aligning and laminating the stack onto a metal support board, and only then firing the stack to densify the glass in the green tape.

These claims have been rejected over the references discussed above further in view of Prabhu. The limitations of IBM, Amendola et al and Vitriol et al have been discussed above.

Appellants' method does not result in misalignment between green tape layers because, prior to firing, they adhere the aligned green tapes onto a support substrate that prevents shrinkage in the x and y dimensions. All of the shrinkage on firing occurs only in the z, or thickness dimension, and thus no misalignment occurs. Thus applicants' method solves the problems of misalignment, and distortion of fine patterns during the lamination step as well.

Prabhu does disclose adhering a green tape stack to a metal support board to prevent misalignment and shrinkage in the x and y dimensions. This reference was discussed in appellants' specification in the paragraph beginning on the last line of page 2. However, Prabhu does not discuss or suggest embossing to form any type of pattern in a green tape, or buried passive components, such as would lead one skilled in the art to the present invention, even if considering the four references together, which appellants believe is improper.

Again, it is appellants, not Prabhu, who teach the combination of preparing green tapes by embossing and screen printing fine patterns, forming a green tape stack and burying

the embossed green tape in the stack, followed by aligning and firing the stack.

The presently claimed invention permits embossing fine patterns into the surface of a green tape and filling them by screen printing, prior to firing the green tape. Because the embossing method permits channels of an appropriate depth, width and length to be made with an embossing tool under heat and pressure, after filling the green tapes can be stacked, aligned and laminated to form a package, or to form buried passive components, without distorting the fine patterns, because none of the filler materials extend above the surface of the green tapes.

However, even if it were obvious to form buried green tape elements onto metal support boards as in Prabhu, since the first and second steps of the present process are unobvious, as discussed above, the addition of a third step does not make the subject matter as a whole obvious, See In re Hirao, 190 USPQ 15 (CCPA 1976).

SUMMARY

The present method requires that all of the desired components, transmission lines and the like, are formed by first embossing channels or openings in a green tape and then filling

the channels by screen printing a suitable ink, and results in lines that do not become distorted during the application of heat or pressure, and which only requires a single firing step to form a multilevel package. Adhering the green tape stack to a support substrate so as to eliminate x and y shrinkage during firing, as required by claims 9 and 11, further ensures that the embossed patterns are maintained during the firing step, without distortion or misalignment between the green tape layers or between the green tape stack and the support substrate.

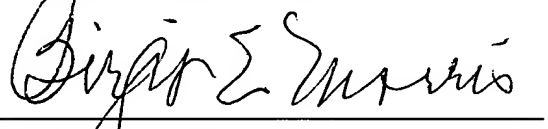
None of the prior art references suggest or disclose the presently claimed process, nor render it obvious. Appellants submit the combination of references cited by the Examiner are based solely on hindsight after viewing the present disclosure, which is improper.

Thus appellants submit the present claims are patentable over the references, and that the rejections should be

overturned. Accordingly, appellants request that the rejections be reversed and claims 1-7, 9 and 11 be allowed.

Respectfully submitted,

MICHAEL JAMES LIBERATORE et al

By 

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APPENDIX

1. A method of forming transmission lines and openings for buried passive components in green tapes comprising

embossing a channel or opening directly into the surface of a green tape using an embossing tool having a desired pattern thereon using heat and pressure sufficient to transfer the pattern from the embossing tool to the green tape, and

screen printing a suitable ink into the channels or opening to fill the channel or opening.

2. A method according to claim 1 wherein embossed transmission line channels are filled with a conductive ink.

3. A method according to claim 2 wherein the conductive ink includes silver powder and an organic vehicle to provide a viscosity of about 25-30 poise.

4. A method according to claim 1 wherein embossed openings are made in a green tape and screen printed to fill the opening using a resistor ink.

5. A method according to claim 1 wherein embossed openings are made in a green tape and screen printed to fill the opening using a capacitor ink.

6. A method according to claim 5 wherein said capacitor ink includes lead magnesium niobate.

7. A method according to claim 5 wherein said capacitor ink includes barium titanate.

9. A method of making buried passive components comprising

a) embossing an opening of a desired shape and size directly on the surface of a green tape;

b) filling said opening by screen printing with an ink including said component material;

c) burying said green tape in a green tape stack;

d) aligning and laminating said stack onto a metal support board coated with a low melt temperature glass; and

e) firing said stack to remove organic materials and to densify the glass of the green tape.

11. A method according to claim 9 wherein said support board is of metal.